25, hibernated in any sheltered area until June 10. Imagos, June 22 to 26, all dark form.

Balduf, W. V., Proc. Ent. Soc. Wash., XXXII, 1930, pp. 31, 36.

Pyrausta pertextalis Lederer

Seems to be a general feeder. F. M. Jones reared it at Martha's Vineyard, Mass. on *Clethra alnifolia,* the moths emerging July 27 to Aug. 11. At New Lisbon, N. J., I reared it webbing the terminal shoots of *Chenopodium album* (lamb's quarters), the moths emerging Aug. 10.

New Jersey Light-trap Versus Human Bait as a Mosquito Sampler

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Introduction

Those interested in determining the extent and variety of an adult mosquito population in a given area have long sought sampling methods which would give an accurate cross section of the insect concentration. Inspection of diurnal rests and baiting with horses, cattle, goats, chickens and rabbits, are among the methods tried with varying success. The fact that many insects are attracted to light was the basis for the development of the New Jersey mosquito trap, which was devised in an effort to establish a sampling device free from the many objectionable features inherent in some of the other procedures.

The New Jersey trap has been a boon to mosquito workers. It has not proven a panacea, however, and its catches are still being contrasted with those obtained by the other methods, in an effort toward further evaluation. Although Carpenter (1942) felt that the trap compared favorably with hand collection methods for measuring imago densities of *Anopheles quadrimaculatus,* Huffaker and Back (1943) concluded that this method did not serve as a good indicator of concentrations of

this species. They state further that they are convinced that the New Jersey trap does not catch a representative sample of a mixed mosquito population.

In order to secure data which might further elucidate the bait-versus-trap controversy, the writer spent considerable time during July and August of 1944 allowing himself to be bitten, as a control on a New Jersey trap which was operating a short distance from his bite site. The results are given below.

Method

On 22 occasions in July and 23 in August, the light trapping and baiting were done on the same evenings. Each location was at a fixed spot, 82 feet apart. The light trap was in plain view of the baiting site.

The baiting costume was designed for the greatest collecting efficiency. A coat prevented biting on areas which were difficult to reach, and the wearing of shorts insured a generous feeding area. Sitting on a low stump, the baiting was begun at approximately 8:45 P.M., Eastern War Time, and continued for 30 minutes. At this time of day the light had faded to a point where it was just possible at the beginning of operations to catch the first few mosquitoes with the unaided eye. A flash light, shaded so that it gave only very weak illumination, was used as darkness increased.

A vial, with chloroform as the killing agent, was placed over each feeding mosquito until she was immobilized. It is the writer's belief that practically every individual which alighted to feed during the whole 1,350 minutes of baiting was successfully taken. On rare occasions, when feeding was heaviest, a female would engorge and fly off before she could be caught.

The light trap, operating with a 25 watt, white frosted bulb, was turned on as baiting commenced, and continued to run throughout the night. It was switched off at about 7:00 A.M.

Only female mosquitoes are considered in these analyses. Also, whereas it is known that several species of *Culex* were taken (*C. pipiens, C. salinarius, C. apicalis,* and probably *C. restuans*), these are lumped together in the computations be-

TABLE

Mosquito Species	Total catch	*Culex* species	*Aedes vexans*	*Aedes canadensis*	*Aedes cantator*	*Aedes sollicitans*	*Aedes trivittatus*	*Aedes taeniorhynchus*	*Anopheles punctipennis*	*Mansonia perturbans*	*Uranotaenia sapphirina*	*Psorophora confinis*	*Psorophora ciliata*	*Orthopodomyia signifera*	*Culiseta inornata*
Light Trap Alone															
Number	467	318	94	2	2	7		1	27		1	4		2	1
% of catch		68.1	20.1	0.43	0.43	1.5		0.21	5.7		0.21	0.85		0.43	0.21
Bait Catch Alone															
Number	1104	888	102	1	60		1	1	47	2			1		
% of catch		80.4	9.2	0.09	5.4		0.09	0.09	4.3	0.17			0.09		
Trap and Bait Catches Combined															
Total number	1571	1206	196	3	62	7	1	2	74	2	1	4	1	2	1
% taken by trap	29.7	26.4	48.0	66.7	3.2	100	0	50.0	36.5	0	100	100	0	100	100
% taken by bait	70.3	73.6	52.0	33.3	96.8	0	100	50.0	63.5	100	0	0	100	0	0

cause of the difficulty in satisfactorily separating the females of these species.

Observations

On examining the table it is seen that a total of 1571 mosquitoes was taken, 476 (29.7 per cent) by trap, and 1104 (70.3 per cent) by bait. It is noted at once that, at least with the particular bait individual employed, baiting was numerically considerably more efficient as a mosquito attractant than was a 25 watt lamp. The 1104 specimens caught feeding means that a mosquito was taken for each 1.2 minutes of the entire 1350 minute bait period.

Briefly considering the bait collection alone (1104 females), we find that most of the mosquitoes were *Culex* (888 specimens), with *Aedes vexans* next in order (102 specimens). These, then, comprised nearly 90 per cent of all biters. *Aedes cantator,* a fierce biter, was represented by 60 individuals (5.4 per cent), while *Anopheles punctipennis,* which bred generally in the area, accounted for 47 (4.3 per cent).

Compared with these data, the light trap catch (467 females) likewise had *Culex* (318 individuals) and *A. vexans* (94 individuals) constituting nearly 90 per cent of the total. The trap attracted *A. punctipennis* in about the same percentage (5.7 per cent; 27 individuals) as did the bait, but was strikingly ineffective for *Aedes cantator* (2 specimens; 0.43 per cent). The other species listed were taken by one method or the other in numbers too small to warrant comparison.

Even more interesting are the figures obtained when both attraction methods are considered together. The general superiority of the human bait over white light (25 watt) has already been noted. Baiting is obviously of no value, however, where males and non-biting species are concerned. Of 1205 *Culex* mosquitoes caught, almost three-quarters of these purely pest types responded to bait (73.6 per cent). *Aedes vexans,* the other pest species present in fair numbers (196 females), was taken approximately equally by both methods. The anopheline, *A. punctipennis,* found bait more attractive than light by a ratio of somewhat less than two to one.

The greatest divergence was again noted for *Aedes cantator.* Of the 62 females taken, 60 were biters, only 2 (3.2 per cent) going into the trap.

Discussion

In the survey reported here there are a number of points to be noted. First, the two attraction sites were not very far apart (82 feet). In a study made in Puerto Rico, Pritchard and Pratt (1944) found that bait (horse, calf) near a light attracted abnormally high numbers of anophelines. When moved to a position 200 feet from the light there was a sharp decline in the baited catch. What the baiting results would have been in the present experiment, had the bait site been further removed from the trap, we of course do not know.

Also, there is known to be a marked difference in attractability among human beings. Weathersbee (1944), in testing this point on Puerto Rican *Anopheles albimanus,* found horses over twenty times more efficient than men, with individual equines being relatively uniform in attractiveness, while different human beings varied considerably in this respect. Although not tested in this experiment, the writer knows from past experience that among human beings he appears to be a better than average attraction. It is possible, therefore, that had a different bait-subject similarly exposed himself to the ravages of these insects, the attraction rates might have varied from the present figures.

The baited catches in the present report were made during the 30 minute period beginning at dusk. For most local forms this is certainly the time of greatest activity and food-seeking, a fact which was fully appreciated by the baitee. In this connection, it was pointed out by Huffaker and Back (1943) that from an activity peak reached at dusk, most species of mosquitoes decline in this respect during the first three hours thereafter. The decline in activity was most noticeable after the first hour. *Anopheles quadrimaculatus,* on the other hand, they found to be an exception, since there was an increase in its activity until midnight at least.

From the above discussion it can be seen that the light trap catch may have suffered somewhat, first by its nearness to the bait station, second by the fact that baiting was done during a period of great mosquito activity, when food seeking was at its height, and possibly also because an apparently attractive individual did the baiting. On the other hand, the baiting lasted only 30 minutes, whereas the light trap ran all night, thus being in operation during the dawn period of revived activity. The trap partly compensated, too, by taking numerous engorged mosquitoes.

There is also the question as to whether or not the New Jersey trap catches a representative sample of a mixed mosquito population. Huffaker and Back (1943) felt that it did not. Because of the smallness of the present totals, the data are hardly more than suggestive. However, it appears that, for the few species with sufficient numbers for comparison, the trap attracted roughly the same percentage as the bait. The striking exception was the exceedingly homophilous *Aedes cantator*.

Finally, from the point of view of overall efficiency, this particular bait certainly eclipsed the light trap by about 2.5 to 1. If this ratio were adjusted to compensate for the great discrepancy between the operating times of the respective attracting forces, the difference would be still greater. As compared with the trap catches, the bait take for *Culex* (mainly *pipiens* and *salinarius*) was almost 3 to 1, for *Anopheles punctipennis* it was something less than 2 to 1, for *Aedes vexans* about 1 to 1, and for *Aedes cantator* just short of 100 per cent.

Summary and Conclusions

1. For 45 nights during July and August (1944) the writer exposed himself to the bites of mosquitoes for 30 minutes, beginning at dusk (approximately 8:45 to 9:15 E.W.T.).

2. A New Jersey light trap (25 watt, white frosted lamp) was operated during the baiting period and throughout the night. The sites were 82 feet apart.

3. A total of 1571 mosquitoes was caught (females only are included). 70.3 per cent were attracted to the bait, 29.7 went to the trap.

4. Individually, the *Culex* species (1206) preferred the bait (73.6 per cent) to the trap (26.4 per cent); *Aedes vexans* was about equally attracted; of 74 *Anopheles punctipennis,* 27 went to the light while 47 bit; and *Aedes cantator* was quite bloodthirsty, for of 62 taken, 60 were caught feeding. Several other species were taken in numbers too small for comparison.

5. Roughly speaking, the human bait and light trap attracted about equal percentages of the more numerous types of mosquitoes (*Aedes cantator* was the exception). For sheer numbers, on the other hand, the particular bait individual used proved a much better attractant than the 25 watt lamp.

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Another European Entomologist Safe

Mr. H. E. Woodcock of Chicago writes that M. Stempffer of Paris has recently written him. M. Stempffer is one of the best-known Lepidopterists in France, being particularly interested in the little blues of the genus *Lycaena.* A veteran of the first World War, he volunteered again but was held at his position in the Bank of Paris until the Germans took that city. He had joined the Free French and so had to flee, but he managed to return to Paris in 1940 and from then on played a role in the propaganda against the invaders of his country. Being fortunate enough to escape detection he is now free and apparently trying to renew his old entomological friendships.